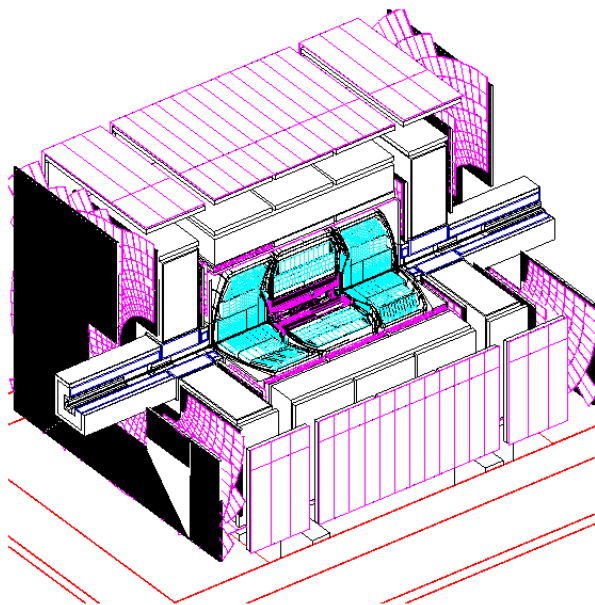


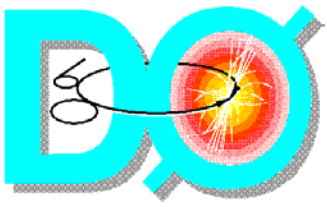
Rochester REU 2002

Summer of Sim



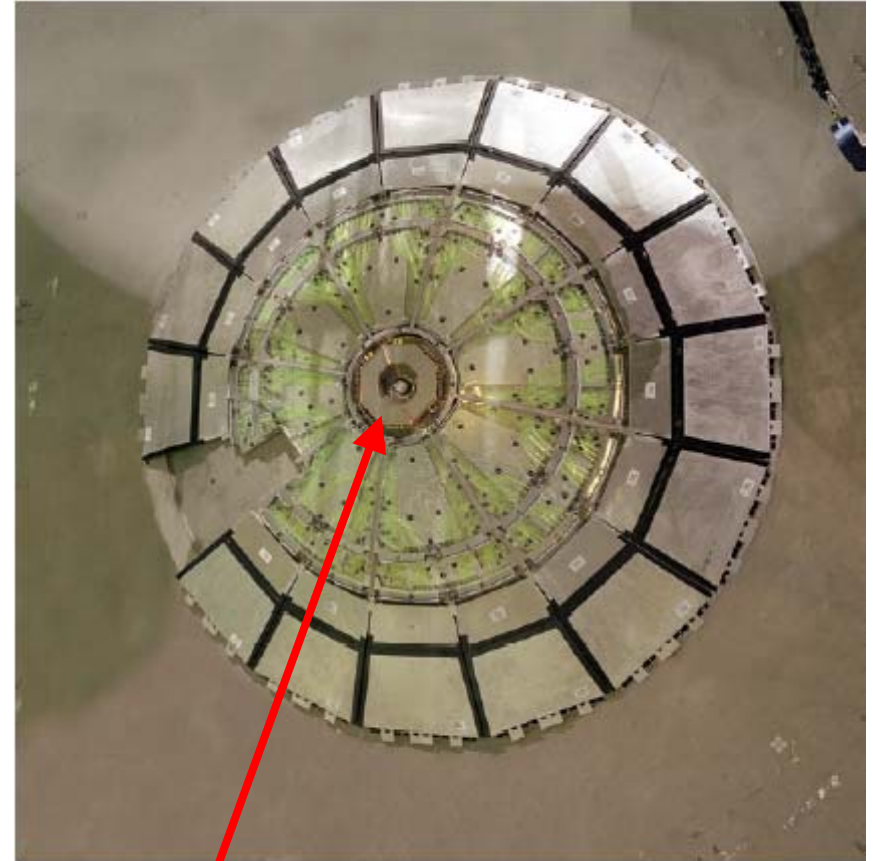
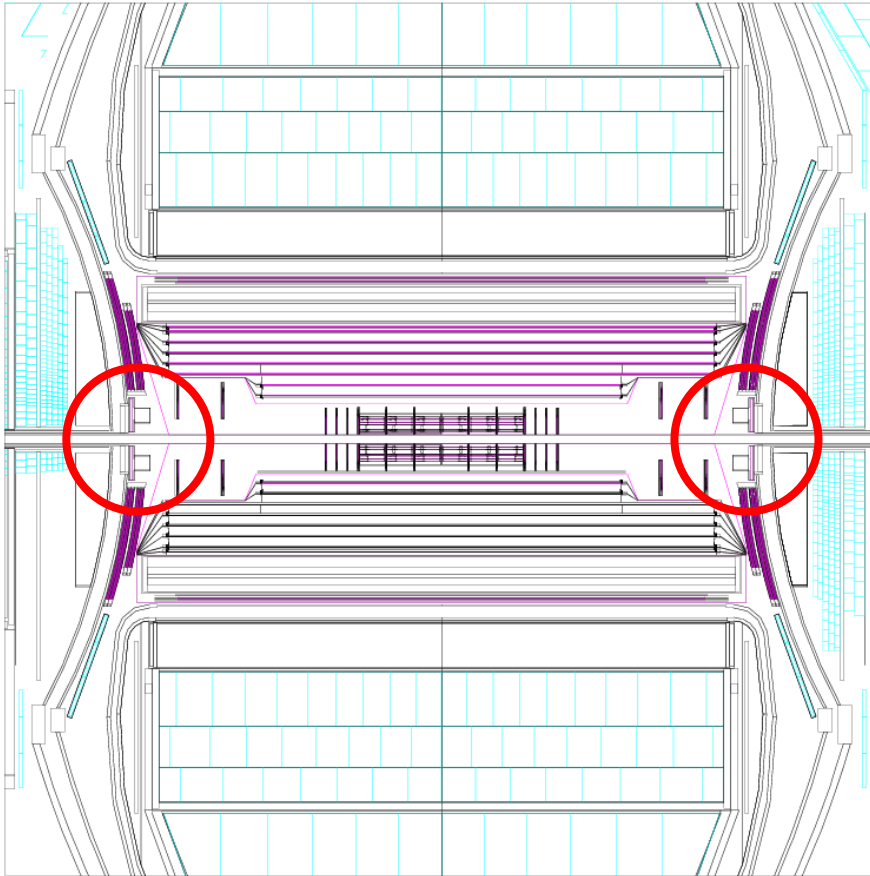
Simulation of the DØ Luminosity Monitor

Joseph Tuggle

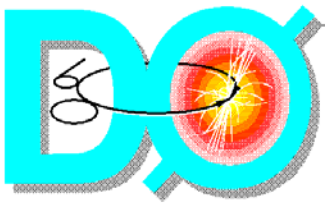


Rochester REU 2002

The Luminosity Monitor

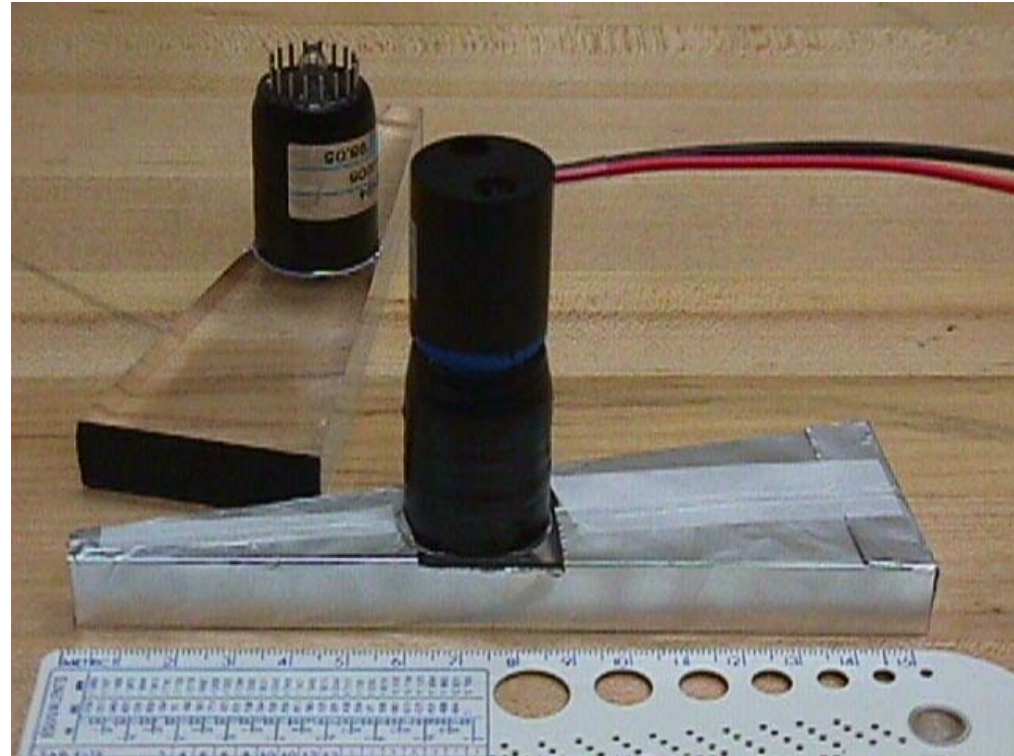
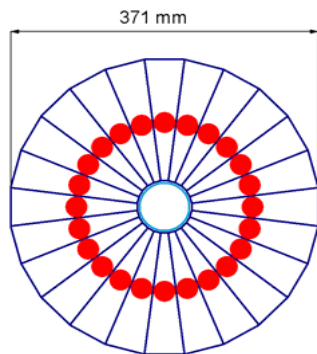
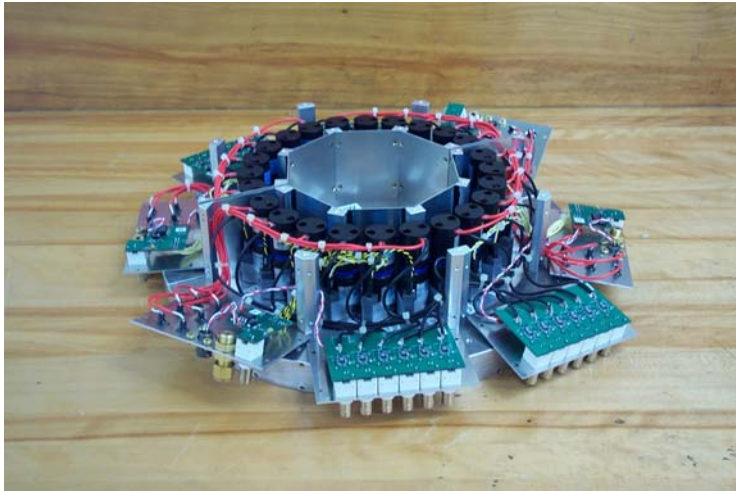


August 8th, 2002

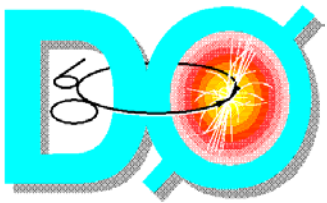


Rochester REU 2002

The Luminosity Wedges

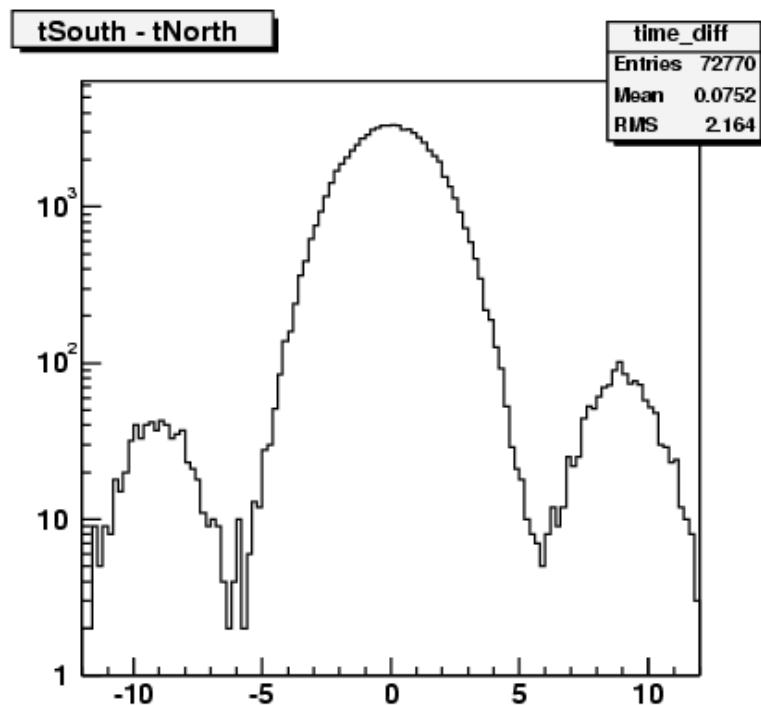


August 8th, 2002

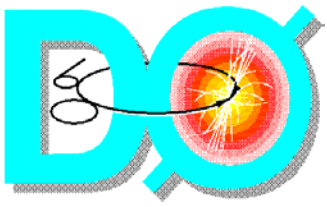


Rochester REU 2002

The Luminosity Monitor is a Timing Detector

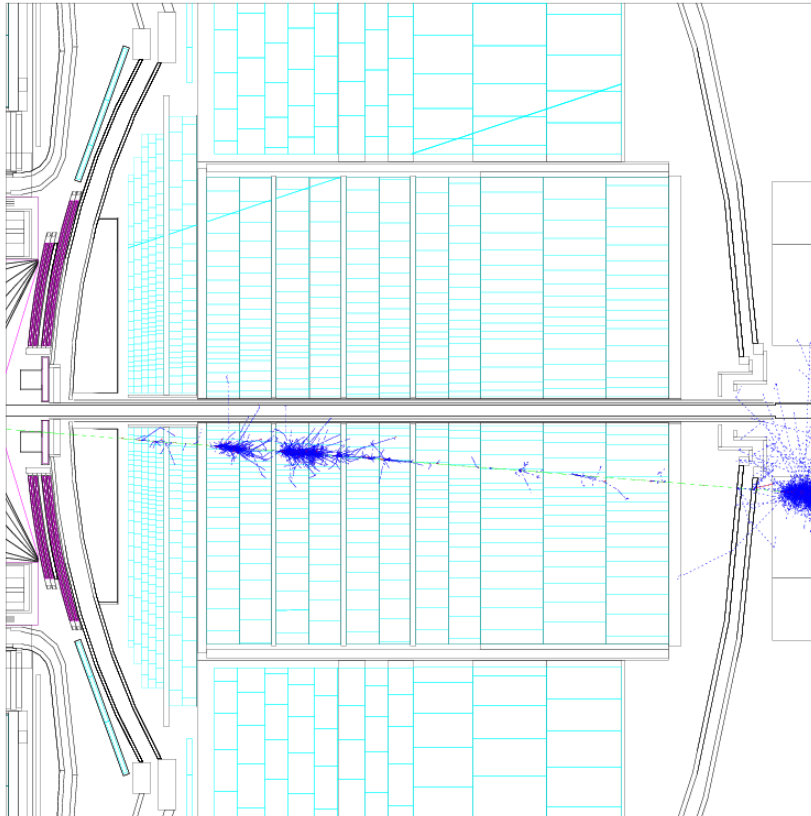


- We see the time difference between hit coincidences in the North and South counters.
- Timing information gives us spatial information, so we can use the LM as a vertex detector as well.

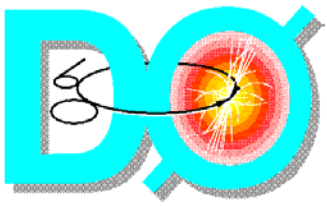


Rochester REU 2002

DØSim Digitization



- DØGSTAR gives us Energy Deposited and Time of Flight
- Need to convert that to electronics output



Rochester REU 2002

Electronics Output

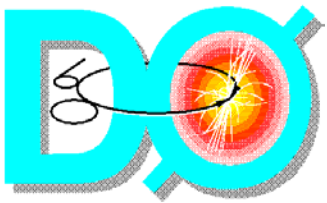
TC3	TC2	TC1	TC0
TC7	TC6	TC5	TC4
TIME		CHARGE	
TIME		CHARGE	
TIME		CHARGE	
TIME		CHARGE	
TIME		CHARGE	
TIME		CHARGE	
TIME		CHARGE	
TIME		CHARGE	

TIME

000	V	TDC (12 Bits)
-----	---	---------------

CHARGE

Energy (8 bits)	V	Correction (7 bits)
--------------------	---	------------------------

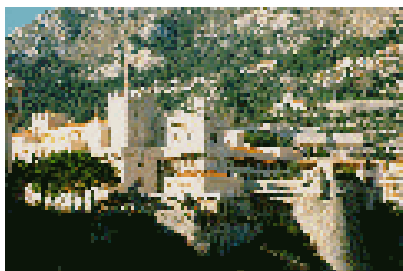


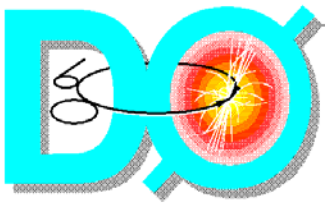
Rochester REU 2002

Fast *Monte Carlo*

Find out:

- Vertexing ability
- Efficiency
- Acceptance

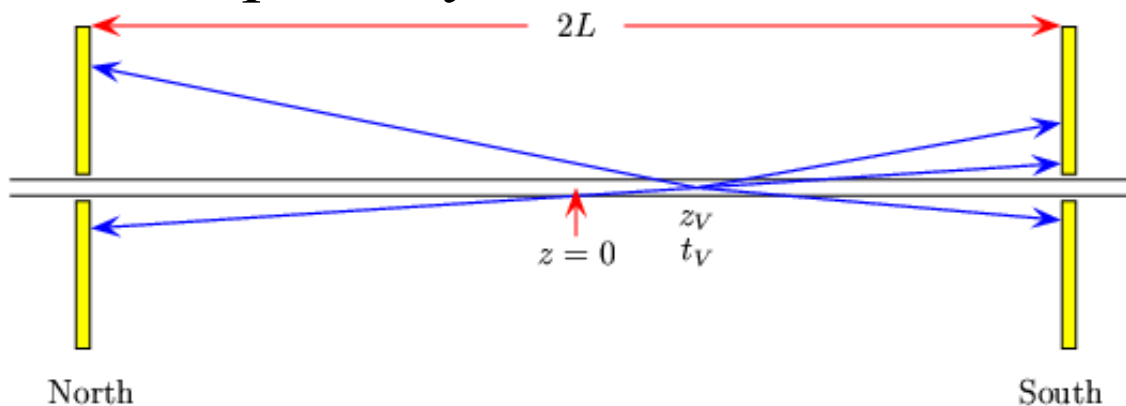


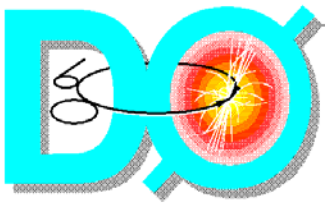


Rochester REU 2002

Fast Monte Carlo: Event Generation

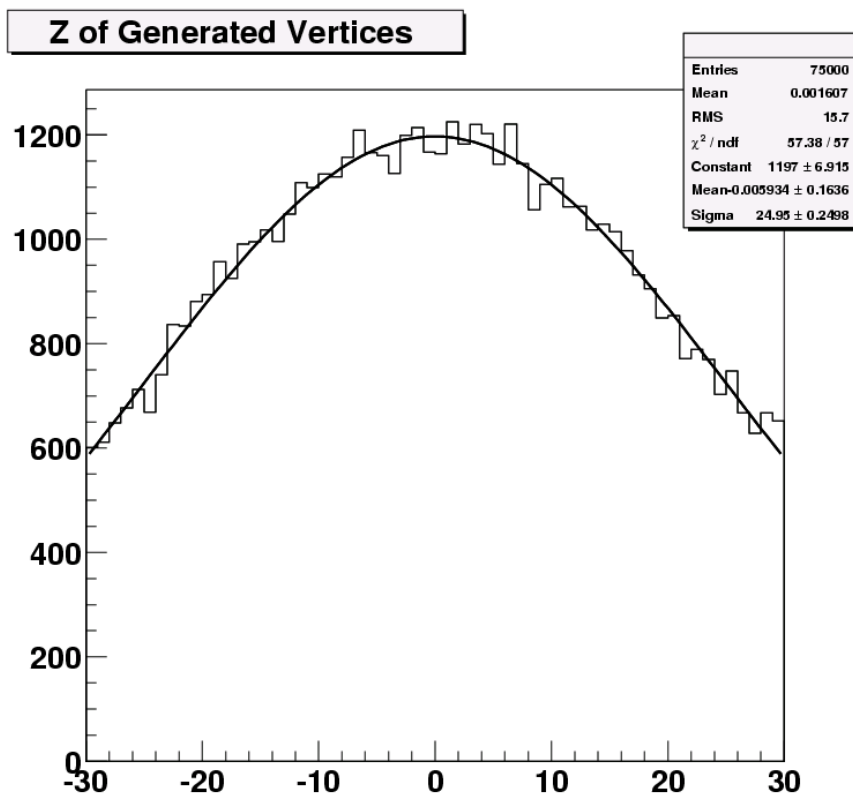
- Generate events using Pythia
- Create one to three primary vertices



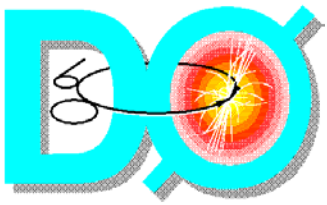


Rochester REU 2002

Fast Monte Carlo: Event Generation

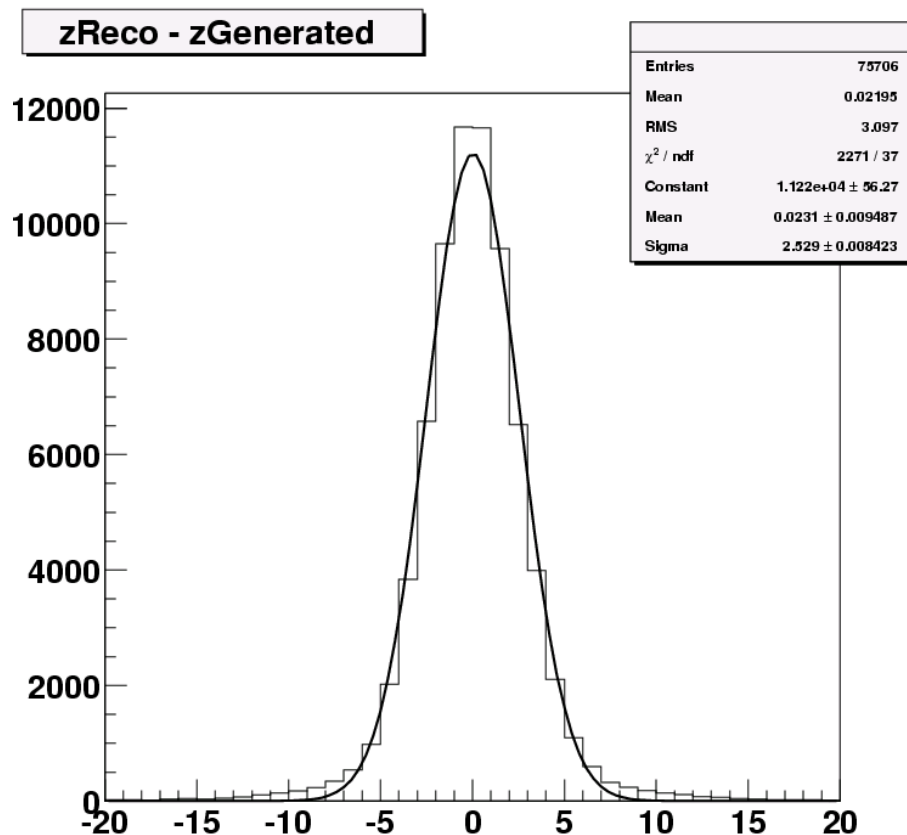


- Generate Z of vertices with Gaussian of width 25cm (consistent with beam)
- Accept only long-lived, charged particles (e.g., π^\pm , K^\pm , p, pbar)
- Extrapolate paths to the Luminosity Monitors

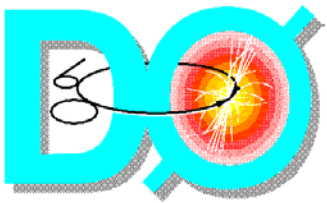


Rochester REU 2002

Fast Monte Carlo: Z Reconstruction

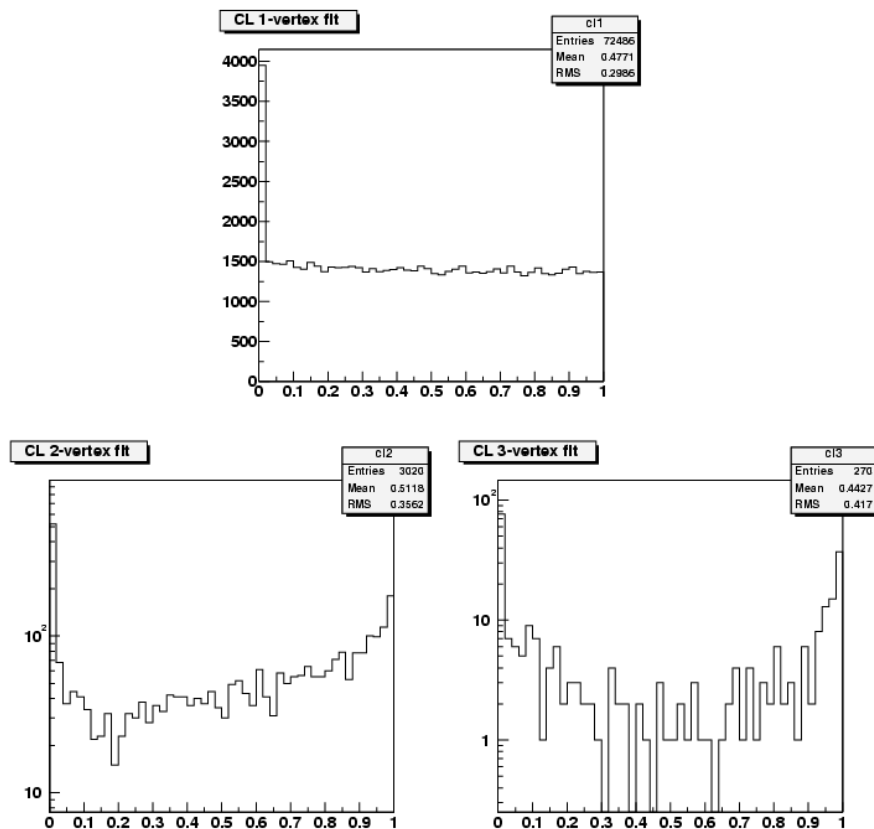


- Reconstruct up to three vertices
- Least Squares fit of z_{vertex} and t_{vertex} based on time of hits
- Reconstruction width is 2.5cm

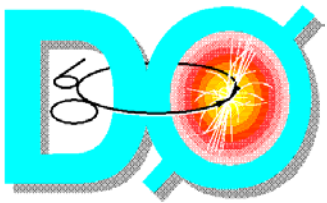


Rochester REU 2002

Fast Monte Carlo: Confidence Level

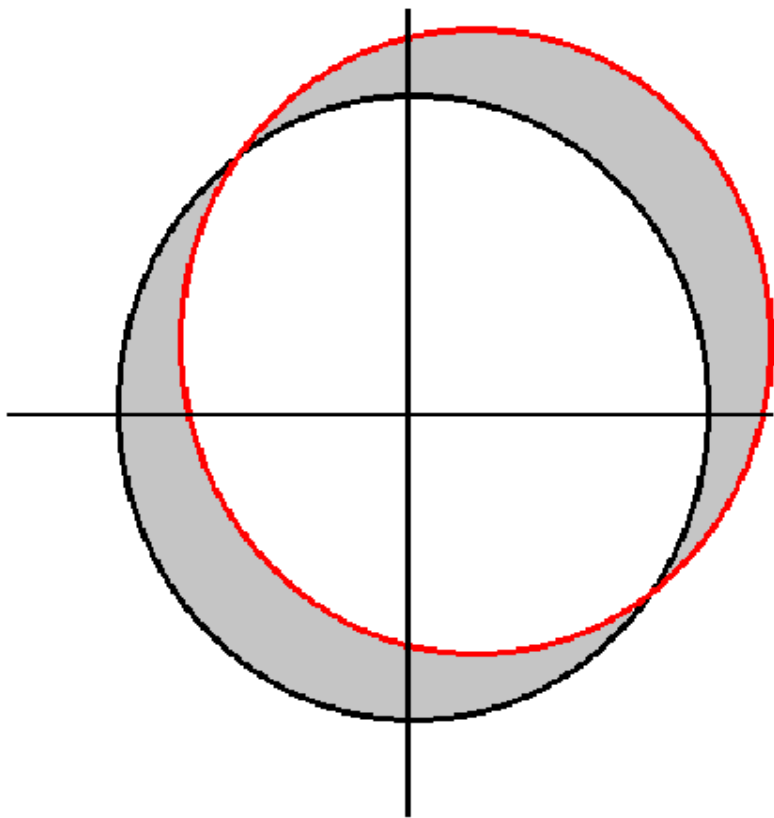


- If the confidence level is below 1%, split the vertex
- Label a vertex “found” if it is within 9cm of a generated vertex.
- Finding rate is 95% for single vertex fits, 50% for two-vertex fits
- Could use confidence level of single-vertex fit as a multiple interaction flag

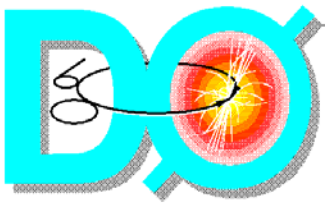


Rochester REU 2002

Fast Monte Carlo: (X,Y) Reconstruction



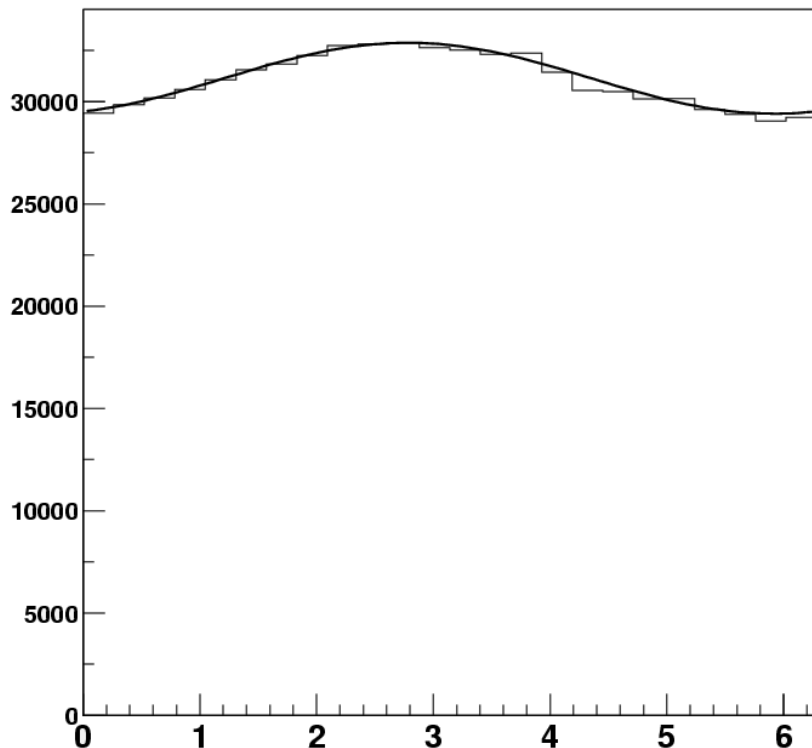
- Off-center beam gives non-uniform population of wedges
- The distribution can be represented as two circles, offset from each other
- The area difference vs. ϕ is a simple cosine function



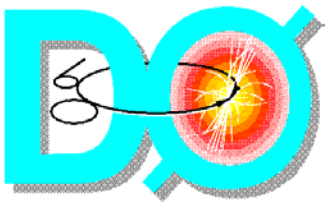
Rochester REU 2002

Fast Monte Carlo: (X,Y) Reconstruction

Scalers vs. Phi

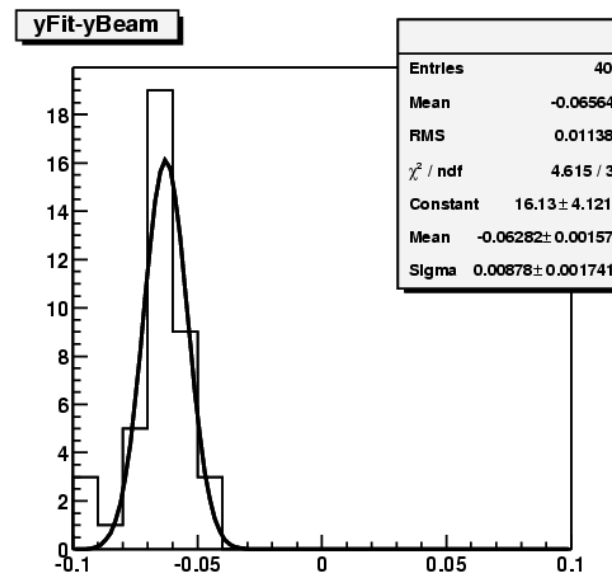
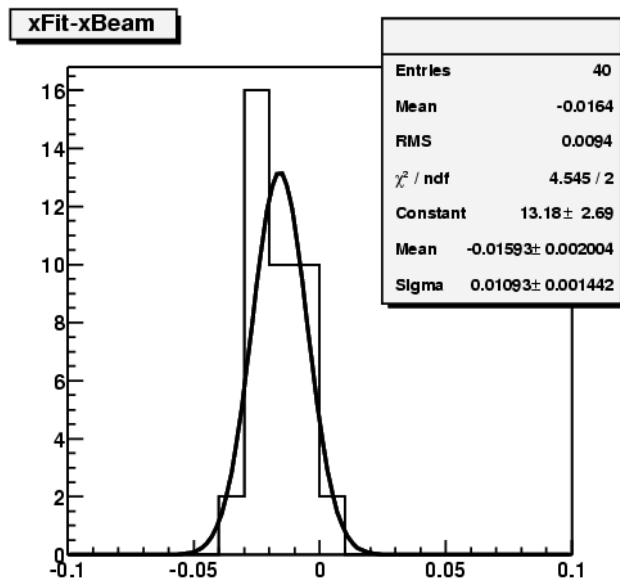


- Scalers:
 $A + B\cos(\phi - C)$
- Radial deviation:
 $R = 4.05 * (B/A)$
- $X = R * \cos(C)$
- $Y = R * \sin(C)$

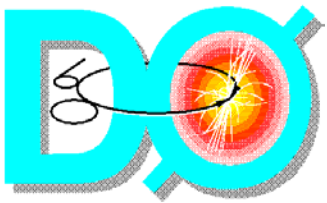


Rochester REU 2002

Fast Monte Carlo: (X,Y) Reconstruction



- Appears to be a bias towards a small Y reconstruction
- Effect is less apparent in X



Rochester REU 2002

Status

- Digitization
 - Ready to implement electronics programming
 - Need to code digitization software to match electronics
- Fast Monte Carlo
 - Completed
 - Upgrades:
 - Better geometry for wedges
 - More accurate particle tracking
 - Better constant for radial beam deviation